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Checklist of Bloodfeeding Mites (Acari: Spinturnicidae) from the Wings of Bats (Mammalia: Chiroptera) in the Manú Biosphere Reserve, Peru

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Abstract

A survey collection of mites of the family Spinturnicidae from Peruvian bats includes 11 species of *Periglischrus* (*acutisternus*, *gameroi*, *grandisoma*, *herrerai*, *hopkinsi*, *iheringi*, *micronycteridis*, *ojasti*, *paracutisternus*, *paravargasi*, and *ramirezi*) and 2 *Spinturnix* (*americanus* and *bakeri*); almost all represent new locality records. This survey collection is available for further study at the following repositories: The Harold W. Manter Laboratory of Parasitology, University of Nebraska–Lincoln; the Field Museum of Natural History, Chicago; and the Laboratório de Espeleobiologia y Acarologia, Universidad Nacional Autónoma de México. When spinturnicid mites are collected to avoid cross-contamination by mites among species of bats, parasitic associations are consistently host specific, with *Periglischrus* spp. distributed exclusively on phyllostomid bats, and *Spinturnix* spp. on vespertilionids. Notable disjunctions within the Manú Reserve include an absence of spinturnicids on bats of the genus *Carollia* (Phyllostomidae), or with *Chiroderma villosum* (Stenodermatinae). Mites of the family Spinturnicidae are not normally associated with bats of the families Emballonuridae, Molossidae, or Noctilionidae.

Keywords: bats, ectoparasites, Acari, Spinturnicidae, *Periglischrus*, *Spinturnix*

Resumen

En una colección de ácaros de la familia Spinturnicidae en murciélagos peruanos se encontraron 11 especies de *Periglischrus* (*acutisternus*, *gameroi*, *grandisoma*, *herrerai*, *hopkinsi*, *iheringi*, *micronycteridis*, *ojasti*, *paracutisternus*, *paravargasi*, y *ramirezi*) y 2 *Spinturnix* (*americanus* y *bakeri*); la mayoría representan nuevos registros de localidad. Esta colección está disponible para su posterior estudio en las siguientes instituciones: Laboratorio de Parasitología Harold W. Manter, Universidad de Nebraska–Lincoln, Field Museum of Natural History, Chicago, y Laboratorio de Espeleobiología y Acarología, Universidad Nacional Autónoma de México. Si los espinturnicidos se recolectan evitando la contaminación cruzada de los ácaros, entre las especies de murciélagos, las asociaciones parasitarias son consistentemente específicas al hospedador, con *Periglischrus* spp. distribuido exclusivamente en murciélagos phyllostomidos y *Spinturnix* spp. en vespertilionidos. Las disyunciones notables dentro de la Reserva de Manu incluyen una ausencia de espinturnicidos en los murciélagos del género *Carollia* (Phyllostomidae), o con *Chiroderma villosum* (Stenodermatinae). Los ácaros de la familia Spinturnicidae normalmente no están asociados con murciélagos de las familias Emballonuridae, Molossidae, y Noctilionidae.

Introduction

From 1999 through 2001, an elevational survey of bats and their associated ectoparasites was carried out within the Manú Biosphere Reserve, a UNESCO World Heritage Site in Peru. This large protected area on the eastern slopes of the Andes is located (ca. 11°17′–1311′S, 71°10′–72°22′W) in a region considered to be one of the most biodiverse

in the world. The survey effort was led by a team of field biologists organized by the Field Museum of Natural History, Chicago (FMNH). Bats and their ectoparasitic arthropods were obtained from specific sites along an altitudinal transect ranging from the lowland forests on the bank of the Río Alto Madre de Dios to high on the eastern slopes of the Andes. Bats were collected at the following localities: Madre de Dios, Quebrada Aguas Calientes (450 m); Madre de Dios, Maskoitania (480 m); Cuzco, Consuelo (1000 m); Cuzco, San Pedro (1480 m); Cuzco, Suecia (1920 m); Cuzco, Pillahuata (2460 m); Cuzco, La Esperanza (2880 m); and Cuzco, Puesto de Vigilancia Acjanaco (3450 m). Bats were captured, primarily in mist nets, and taken to a temporary field laboratory, where they were individually euthanized, examined, and sampled for ectoparasites. Arthropods were preserved in carefully labeled vials of ethyl alcohol, linking each sample to a museum voucher specimen of the host individual. This survey was planned and organized with an emphasis on careful collecting of both bats and ectoparasites, hoping to limit data errors and problems caused by the contamination of one sample with the ectoparasites of another. All collected bats were accessioned into the Mammal Collection of the FMNH; host identifications in this paper can be verified and updated online by searching the FMNH catalog numbers. More information on the Manú Biosphere Reserve, the surveys, and fauna may be found in Solari et al. (2006) and Patterson et al. (2006.)

Mites of the family Spinturnicidae (Acari: Mesostigmata) are permanent hematophagous parasites that occur on the wings and tail membranes of certain taxonomic groups of bats (Mammalia: Chiroptera). In the Neotropics, species of four genera of these ectoparasites are distributed exclusively across four families of bats. Species of the genus *Spinturnix* von Heyden 1826 are associated with Vespertilionidae, while species allocated to the genus *Periglischrus* Oudemans 1902 occur only on the Phyllostomidae. Species of *Cameronieta* Machado-Allison 1965 occur on the Mormoopidae, and species of *Mesoperiglischrus* Dusbábek 1968 occur only on bats of the family Natalidae. Species of *Spinturnix* are cosmopolitan in association with their widely distributed vespertilionid hosts, but the other three mite genera are primarily Neotropical in distribution. Species diversity of bats in the Manú Reserve is high, and representative species of seven families collected during the survey include the Emballonuridae, Phyllostomidae, Noctilionidae, Furipteridae, Thyropteridae, Molossidae, and Vespertilionidae. Of particular note, mites of the family Spinturnicidae were found only on species of Phyllostomidae (*Periglischrus*) and Vespertilionidae (*Spinturnix*). Despite efforts to collect representative species of all chiropterans in each geographical area investigated, bats of the families Mormoopidae and Natalidae were not sampled in the Manú Reserve. Fifty-four species of phyllostomid bats were sampled for ectoparasites in this survey, and 40 species were found to be infested with spinturnicids (see Table 1). Taxonomically, all these mites were allocated to the 14 nominal species of *Periglischrus*.

This taxonomic species catalog presents the results of a field survey with subsequent identification of all spinturnicid mites recovered. This catalog also provides taxonomic information about the mites that were collected and prepared for identification and specific museum collections where specimens are deposited. Because the formal identification of representative specimens mounted on slides served as the basis for the determination of the remaining material that is preserved in vials of alcohol, this collection represents a source of comparative material for further research on spinturnicid mites in the Neotropical region. The synoptic collection of specimens mounted on microscope slides that were identified includes catalog numbers HWML139513–139821. The Manú survey research collection of voucher specimens in alcohol was deposited in the arthropod collections of the FMNH; another smaller collection of spinturnicid material from this survey was deposited at the Laboratorio de Espeleobiologia y Acarologia, Universidad Nacional Autónoma de Mexico (UNAM).

Species Accounts

Each species account includes the following sections:

(1) *Type Host and Locality*: Taken from the original species description.

(2) *Remarks*: Parasite-host relationships observed in the Manú Reserve are compared with those reported in the literature. Definitions used in the Remarks sections include:

Monoxenous associations include permanent relationships with a single host species.

Stenoxenous associations include associations of mites with a monophyletic group that usually includes a single genus (or subgenus) of host.

Oligoxenous associations include associations of mites with a relatively wide range of phylogenetically related hosts.

Polyxenous associations include mites that occur on bats that have separate phylogenetic histories and are not monophyletic (no polyxenous spinturnicids are known).

(3) *Reference*(*s*): Includes other records of this host/mite association published since the seminal work of Rudnick (1960).

Acari: Mesostigmata: Spinturnicidae

Periglischrus Kolenati, 1857

Type of the Genus: Periglischrus caligus Kolenati, 1857, by subsequent designation (Oudemans, 1903).

Remarks: *Periglischrus caligus* is a stenoxenous associate of glossophagine bats of the genus *Glossophaga*. Although these bats were not recovered during the Manú survey, Mendoza-Uribe and Chavez-Chorocco (2002) previously reported this mite from *Glossophaga soricina* (Pallas, 1766) from the District of Los Aquijes, Peru.

Periglischrus acutisternus **Machado-Allison, 1964**

Type Host and Locality: *Phyllostomus elongatus* (É. Geoffroy, 1810), Cariptio, Monagas State, Venezuela.

Remarks: Stenoxenous, associated with bats of the genus *Phyllostomus* in the Manú Reserve. This large-bodied species of mite often occurs in a presumed sympatric relationship with the smaller-bodied *P. torrealbai*; both species were collected from 4 of 7 spinturnicid-infested *P. hastatus* and from 1 of 2 *P. elongatus*.

References: Venezuela: Machado-Allison, 1964; Machado-Allison, 1965; Herrin and Tipton, 1975. Brazil: Confalonieri, 1976; Gettinger and Gribel, 1989; Dantas-Torres et al., 2009; Silva and Graciolli, 2013. Colombia: Marinkelle and Grose, 1981. Costa Rica: Casebeer, 1966. Panama: Furman, 1966.

Periglischrus gameroi **Machado-Allison and Antequera, 1971**

Type Host and Locality: *Lonchorhina aurita* Tomes, 1863, 18 km N Valera (El Cenizo), Trujillo State, Venezuela.

Remarks: Stenoxenous on *Lonchorhina* spp. This species is known from both *L. aurita* and *L. orinocensis* in Venezuela (Herrin and Tipton, 1975). This is a new record of this association with the type host in the Manú Reserve.

References: Venezuela: Machado-Allison and Antequera, 1971; Herrin and Tipton, 1975.

Periglischrus grandisoma **Herrin and Tipton, 1975**

Type Host and Locality: Phylloderma stenops Peters, 1865, San Juan Rio Manipare, 163 km ESE of Puerto Ayacucho, Territorio Federal Amazonas, Venezuela.

Remarks: Monoxenous. This is a large-bodied species of wing mite that infests the monotypic type host, *P. stenops*. *Periglischrus grandisoma* occurs in association with the smaller *P. paratorrealbai*, often occurring on the same host individuals. These associations are known among species of *Phylloderma* and *Phyllostomus*, but it is possible that these sympatric pairs occur in other species of the Phyllostominae. Confalonieri (1976) reported on a series of spinturnicids—3F, 2M, 6DN, 1PN from *P. stenops* in Brazil—but failed to identify the specimens to the level of the species. These specimens may actually be referable to the sympatric pair *P. grandisoma*/*P. paratorrealbai*, but these mites need to be examined and identified.

Reference: Venezuela: Herrin and Tipton, 1975.

Periglischrus herrerai **Machado-Allison, 1965**

Type Host and Locality: Desmodus rotundus rotundus (É. Geoffroy, 1810), from Caripito, Monagas, Venezuela.

Remarks: Monoxenous, known only from the common vampire, *D. rotundus.* Spinturnicids are as yet unknown from the other desmodontines, including *Diphylla ecaudata* Spix, 1823 and *Diaemus youngi* (Jentink, 1893).

References: Venezuela: Machado-Allison, 1965; Herrin and Tipton, 1975. Brazil: Confalonieri, 1976; Gettinger and Gribel, 1989; Almeida et al., 2011; Silva and Graciolli, 2013. Colombia: Machado-Allison and Antequera, 1969; Marinkelle and Grose, 1981; Tarquino-Carbonel et al., 2015. Mexico: Sheeler-Gordon and Owen, 1999. Panama: Furman, 1966; Morales-Malacara et al., 2017. Paraguay: Morales-Malacara et al., 2017. Peru: Mendoza-Uribe and Chavez-Chorocco, 2002. Trinidad: Furman, 1966.

Periglischrus hopkinsi **Machado-Allison, 1965**

Type Host and Locality: *Lionycteris spurrelli* Thomas, 1913 from the Boca de Villacoa (río Orinoco), Bolívar, Venezuela.

Remarks: A single male of *P. hopkinsi* was collected from the *L. spurrelli* in the Manú Reserve. *Periglischrus hopkinsi* is known only from females; males remain undescribed. I am not formally describing this specimen at this time. Although this species was described using females from *L. spurrelli*, Herrin and Tipton (1975) reported it also from species of *Lonchophylla*. More collections are needed from lonchophylline bats.

Reference: Herrin and Tipton (1975).

Periglischrus iheringi **Oudemans, 1902**

Type Host and Locality: Platyrrhinus lineatus (É. Geoffroy, 1810), Sao Paulo, Brazil.

Remarks: Periglischrus iheringi is oligoxenous and the most commonly collected wing mite in the Neotropics. This name is applied to mites infesting the wings of stenodermatine bats, the most speciose subfamily of the Phyllostomidae. In the Manú Reserve, nineteen species belonging to eight genera of stenodermatines were infected with this highly composite mite species.

References: Peru: Mendoza-Uribe and Chavez-Chorocco, 2002. Mexico: Sheeler-Gordon and Owen, 1999. Colombia: Marinkelle and Grose, 1981. Costa Rica: Casebeer, 1966. Panama: Furman, 1966. Cuba: Silva Taboada, 1965;

Dusbábek, 1968. Brazil: Confalonieri 1976; Gettinger and Gribel, 1989; Azevedo et al., 2002; Lima-Silva et al., 2009; Dantas-Torres et al., 2009; Silva and Graciolli, 2013; Almeida et al., 2011; Almeida et al., 2016.

***Periglischrus micronycteridis* Furman, 1966**

Type Host and Locality: Micronycteris megalotis (Gray, 1842) from near Borinquen Highway (Canal Zone), Panama.

Remarks: Stenoxenous; on certain phyllostomine *Micronycteris* Gray, 1866. In the Manú Reserve, we collected *P. micronycteridis* from both *Micronycteris minuta* (Gervais, 1856) and *M. megalotis*.

References: Panama: Furman, 1966. Venezuela: Herrin and Tipton, 1975.

***Periglischus ojasti* Machado-Allison, 1964**

Type Host and locality: Sturnira lilium (É. Geoffroy, 1810) from Caripito, Monagas, Venezuela.

Remarks: Periglischus ojasti is stenoxenous, associated with bats of the genus *Sturnira* Gray, 1842, infesting *S. erythromos* (Tschudi, 1844); *S. lilium*; *S. magna* de la Torre, 1966; *S. ororaphilum* (Tschudi, 1844); and *S. tildae* de la Torre, 1959 in the Manú Reserve.

References: Venezuela: Machado-Allison, 1964; Machado-Allison, 1965; Herrin and Tipton, 1975. Costa Rica: Casebeer, 1966. Panama: Furman, 1966 (as *P. aitkeni* syn.). Dominica: Pence et al., 1981. Colombia: Marinkelle and Grose, 1981. Brazil: Confalonieri, 1976; Gettinger and Gribel, 1989; Azevedo et al., 2002; Lima-Silva and Graciolli, 2013; Almeida et al., 2016. Mexico: Sheeler-Gordon and Owen, 1999.

***Periglischrus paracutisternus* Machado-Allison and Antequera, 1971**

Type Host and Locality: Trachops cirrhosus (Spix, 1823), 19 km NW Urama, Yaracuy State, Venezuela.

Remarks: Monoxenous. *Periglischrus paracutisternus* was collected exclusively from the monotypic *T. cirrhosus* in the Manú Biosphere Reserve, Peru.

References: Venezuela: Machado-Allison and Antequera, 1971; Herrin and Tipton, 1975. Brazil: Almeida et al., 2016.

***Periglischrus paravargasi* Herrin and Tipton 1975**

Type Host and Locality: Anoura caudifer (É. Geoffroy, 1818) from 2 km SW Altamira, Barinas, Venezuela.

Remarks: Gettinger and Gribel (1989) found high prevalence of *P. paravargasi* infesting *A. caudifer* in the cerrados of central Brazil. However, this mite was encountered in low prevalence from *Anoura caudifer* in the Manú Biosphere Reserve, Peru.

References: Venezuela: Herrin and Tipton, 1975. Brazil: Confalonieri, 1976; Gettinger and Gribel, 1989.

***Periglischrus ramirezi* Machado-Allison and Antequera, 1971**

Type Host and Locality: Rhinophylla pumilio Peters, 1865, 59 km SE El Dorado (El Mónaco), Bolívar State, Venezuela.

Remarks: Monoxenous. Except for a single record from *Rhinophylla pumilio* in Pará, *P. ramirezi* has been reported only from Venezuela (Machado-Allison and Antequera, 1971; Herrin and Tipton, 1975). *Periglischrus ramirezi* was collected exclusively from *R. pumilio* in the Manú Biosphere Reserve, Peru.

References: Machado-Allison and Antequera, 1971; Herrin and Tipton, 1975.

***Periglischrus tonatii* Herrin and Tipton, 1975**

Type Host and Locality: Holotype female ex. *Lophostoma silvicolum* d'Orbigny, 1836, from 25 km S Puerto Ayacucho, Territorio Federal Amazonas, Venezuela; allotype male from *L. carrikeri* (J. A. Allen, 1910), San Juan, Rio Manapiare (155 m), 163 km ESE Puerto Ayacucho, Territorio Federal Amazonas, Venezuela.

Remarks: This species appears to be stenoxenous, occurring only on *Lophostoma* spp. Samples of *P. tonatii* were collected in the Manú Reserve from the same species as the original type hosts in Venezuela, *Lophostoma silvicola* and *L. carrikeri*.

References: Venezuela: Herrin and Tipton, 1975. Brazil: Silva and Graciolli, 2013.

***Periglischrus torrealbai* Machado-Allison, 1965**

Type Host and Locality: Phyllostomus hastatus (Pallas, 1767), Valle de Caripe, Estado Monagas, Venezuela.

Remarks: Periglischrus torrealbai is the smaller of the two congeneric species occurring in sympatry on bats of the genus *Phyllostomus* Lacépède, 1799. Of seven spinturnicid-infested *P. hastatus*, six were infested with *torrealbai*, four in sympatry with *acutisternus*. Of two infested *P. elongatus* (É. Geoffroy, 1810), both were infested with *torrealbai*, one in sympatry with *acutisternus*. Almeida et al. (2017) have shown that populations of *P. torrealbai*, occurring on different though closely related phyllostomine hosts, display clear and concordant morphometric differences. More field studies are needed to discover how widely these sympatric species-pairs are distributed within the host subfamily Phyllostominae.

References: Venezuela: Machado-Allison, 1964; Machado-Allison, 1965; Herrin and Tipton, 1975. Costa Rica: Casebeer, 1966. Panama: Furman, 1966 (as *P. inflatiseta* syn.). Brazil: Confalonieri, 1976; Gettinger and Gribel, 1989; Almeida et al., 2011; Silva and Graciolli, 2013; Almeida et al., 2016.

***Periglischrus vargasi* Hoffmann, 1944**

Type Host and Locality: Leptonycteris nivalis (Saussure, 1860), Yerbabuena, Estado Guerrero, Mexico.

Remarks: Periglischrus vargasi is a monoxenous parasite of *Anoura geoffroyi* Gray, 1838, in the Manú Preserve. The species boundaries of the "*vargasi* species group" are distributed broadly across the glossophagine genera *Anoura* Gray, 1838 and *Leptonycteris* Lydekker, 1891.

References: Mexico: Hoffman, 1944; Sheeler-Gordon and Owen, 1999. Cuba: Dusbábek, 1968. Venezuela: Machado-Allison, 1965 (as *P. squamosus* syn.). Brazil: Silva et al., 2009; Almeida et al., 2016.

***Spinturnix* von Heyden, 1826**

Type of the Genus: Pteropus myoti Kolenati, 1856, designated by Opinion 128 of the International Commission on Zoological Nomenclature (1936). [= *Spinturnix myoti* (von Heyden, 1826)]

Remarks: The taxonomic boundaries among species of *Spinturnix* remain poorly defined in the New World, and even host associations are unclear.

***Spinturnix americanus* (Banks, 1902)**

Type Host and Locality: Originally reported as a "bat" from a cave in Indiana. Rudnick (1960) proposed *Myotis lucifugus lucifugus* (LeConte, 1831) as the type host.

Remarks: Spinturnicids were not abundant in collections from vespertilionids, but the series of slides from *Myotis albescens* (É. Geoffroy, 1806) FMNH170275 is excellent, with all the life stages present. *Spinturnix americanus* appears to be a stenoxenous parasite of certain species of *Myotis*, throughout the New World.

References: Brazil: Silva and Graciolli, 2013. Dominica: Pence et al., 1981. Venezuela: Herrin and Tipton, 1975.

***Spinturnix bakeri* Rudnick, 1960**

Type Host and Locality: Eptesicus fuscus bernardinus Rhodes from Sunol, Alameda County, California.

Remarks: These mites fall into Rudnick's "group 3," with long lateroventral leg setae, and one of two proximal dorsal setae of femurs I and II are minute. This species infects the common bat, *Eptesicus fuscus* (Palisot de Beauvois, 1796), distributed throughout the Nearctic and into the northern Neotropical region. In Venezuela, Herrin and Tipton (1975) reported this mite from *Eptesicus montosus* (= *E. andinus* Allen, 1914).

References: Cuba: Dusbábek, 1968. Venezuela: Herrin and Tipton, 1975.

Discussion

Even with relatively recent advances in our understanding of spinturnicid morphology (Morales-Malacara, 2001), the conservative taxonomy of the Neotropical Spinturnicidae is probably inadequate for species-level identifications. If so, this catalog may greatly underestimate the number of *Periglischrus* spp. infesting bats from Manú. High levels of intraspecific variation in morphology, especially of the female stase, continue to confound species boundaries within the genus *Periglischrus*. This extreme heteromorphy may be due to the effects of neosomy and accumulating wear and tear on the exoskeleton (teratologies) during a long reproductive lifespan on the exposed wing membranes of a proportionately long-lived host. However, even with these morphometric problems, the taxonomic foundations of the genus reveal clear morphological groupings (Morales-Malacara 2001), and the dichotomous key presented by Herrin and Tipton (1975) remains useful in identifying the adult stase of Neotropical spinturnicids and assigning consistent taxonomic names to the mites with stenoxenous and oligoxenous host associations.

Although biological observations on the Neotropical Spinturnicidae are lacking in the literature, some general aspects of the structure of spinturnicid populations are revealed by examining the basic collection data from the Manú Reserve. Spinturnicid mite populations tend to be highly biased toward the adult stase. Of a total of 1,287 individual mites collected from the wings of 1,051 bats, 51% were females, 30% males, 11% deutonymphs, and 8% protonymphs. Eighty-one percent of all the mites collected were adults, females and males in approximately even numbers, and 27% of the mature females were carrying an internal protonymph. Although slides of more than 200 reproductive females were examined, an internal larva was never observed. This developmental stage is either absent in *Periglischrus* or very short in duration.

The lineage specificity of Neotropical Spinturnicidae is clear; no mites of the family were observed nor collected from any nonchiropteran vertebrates; in addition, despite intense collection efforts, no mites of this family were collected from bats of the families Emballonuridae (n = 9), Noctilionidae (n = 10), Thyroptidae (n = 1), or Molossidae (n = 7). Relatively few bats of the family Vespertilionidae (n = 43) were sampled, and the infestation rates with *Spinturnix* spp. were low when compared to those of the Phyllostomidae. Within the phyllostomid subfamily Carollinae, although *P. ramirezi* is a monoxenous parasite of *Rhinophylla pumilio*, bats of the genus *Carollia* are uninfested with spinturnicid mites. Herrin and Tipton (1975) encountered the same relationships with the large and extensive

Smithsonian Venezuela Collection. *Rhinophylla pumilio* was strongly infected with *P. ramirezi*, but 6665 host samples from *Carollia* spp. contained only 24 spinturnicids; a prevalence of 0.0036 (0.36%). These rare associations are very likely caused by sampling error; spinturnicid mites do not naturally infest bats of the genus *Carollia*. In the Manú Reserve, another interesting disjunction in the distribution of *Periglischrus* was observed (see Table 1); the lack of *Periglischrus iheringi* in association with the stenodermatine, *Chiroderma villosum* (n = 33). In Venezuela, Herrin and Tipton also report this negative association, with a much larger sample size; two mites collected from a host sample of 724 *C. villosum*. Based on some experience in the field, I have also never observed spinturnicid mites on *Chrotopterus aurita* nor on the desmodontines, *Diaemus* and *Diphylla*. More survey research is needed, employing rigorous sampling protocols, and with careful collection and identification of both parasite and host voucher specimens.

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Table 1. Chiroptera sampled for ectoparasites in the Manú Biosphere Reserve

	# Sampled	# Infested	# With spints	Prevalence
Emballonuridae				
Saccopteryx bilineata	7	7	0*	—
Saccopteryx leptura	1	0	0*	—
Peropteryx leucoptera	1	0	0*	—
Noctilionidae				
Noctilio albiventris	10	10	0*	—
Phyllostomidae				
Phyllostominae				
Chrotopterus auritus	1	1	0*	0.00
Phyllostomus elongatus	6	6	2	0.33
Phyllostomus hastatus	8	8	7	0.88
Phylloderma stenops	1	1	1	1.00
Trachops cirrhosa	9	9	4	0.44
Lophostoma silvicola	4	4	1	0.25
Tonatia carrikeri	1	1	1	1.00
Lonchorhina aurita	5	5	1	0.20
Micronycteris hirsutus	1	1	0	0.00
Micronycteris megalotis	5	4	1	0.20
Micronycteris minuta	1	1	1	1.00
Desmodontinae				
Desmodus rotundus	10	10	3	0.33
Glossophaginae				
Anoura caudifer	18	14	5	0.28
Anoura cultrata	1	1	0	0.00
Anoura geoffroyi	45	42	26	0.58
Anoura sp.	1	1	0	0.00
Choeronyscus sp.	1	1	0	0.00
Lionycteris spurrelli	5	3	1	0.20
Lonchophylla handleyi	1	1	0*	0.00
Lonchophylla thomasi	9	6	0*	0.00
Carollinae				
Rhinophylla pumilio	17	12	9	0.53
Carollia brevicauda	44	30	0*	—
Carollia castanea	28	25	0*	—
Carollia perspicillata	67	55	0*	—
Carollia sp.	11	7	0*	—
Sturnirinae				
Sturnira erythromos	109	65	52	0.48
Sturnira lilium	40	38	19	0.48
Sturnira magna	13	13	11	0.85
Sturnira oporaphilum	15	13	7	0.47
Sturnira tildae	38	34	19	0.50

Table 1. Chiroptera sampled for ectoparasites in the Manú Biosphere Reserve (continued)

	# Sampled	# Infested	# With spints	Prevalence
Stenodermatinae				
Chiroderma salvini	15	15	4	0.27
Chiroderma trinitatum	9	9	4	0.44
Chiroderma villosum	33	20	0*	0.00
Vampressa bidens	21	17	10	0.59
Vampressa brocki	2	2	0	0.00
Vampressa melissa	5	3	1	0.20
Vampressa pusilla	2	1	1	1.00
Uroderma bilobatum	32	21	9	0.28
Uroderma magnirostris	6	3	0	0.00
Mesophylla macconnelli	4	4	0	0.00
Vampyrodes caraccioli	23	19	13	0.57
Platyrrhinus brachycephalus	36	23	9	0.25
Platyrrhinus dorsalis	14	10	8	0.57
Platyrrhinus helleri	27	22	13	0.48
Platyrrhinus infuscus	15	14	4	0.27
Platyrrhinus nigellus	15	12	5	0.33
Platyrrhinus vittatus	3	2	2	0.67
Enchisthenes hartii	34	30	28	0.82
Dermanura anderseni	18	11	5	0.28
Dermanura glauca	42	31	18	0.43
Dermanura gnoma	9	5	2	0.22
Artibeus lituratus	35	31	18	0.51
Artibeus obscurus	41	28	1	0.02
Artibeus planirostris	37	33	21	0.57
Thyropteridae				
Thyroptera lavali	1	1	0*	—
Molossidae				
Tadarida brasiliensis	4	4	0*	—
Molossus ater	3	3	0*	—
Vespertilionidae				
Eptesicus brasiliensis	7	7	2	0.29
Eptesicus chiriquinus	6	6	3	0.50
Myotis albescens	10	9	8	0.80
Myotis keaysi	5	5	1	0.20
Myotis nigricans	7	5	0	0.00
Myotis oxyotus	1	1	0	0.00
Myotis riparius	7	7	0	0.00

* Negative associations previously reported in the literature